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THE IMPACT OF GOVERNMENT POLICIES ON FOREST
RESOURCE UTILIZATION

by

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ON FOREST RESOURCE UTILIZATION[1]

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Recent writings in the area of forest utilization are
unanimous in arguing that rates of forest depletion are too
rapid from the social point of view. The extent of virgin
forest is declining rapidly and there is little evidence
that reforestation efforts are achieving any success
(Revilla). Two sources of depletion exist, commercial log-
ging, and informal forest resource utilization by people
living in the uplands (for lumber, fuel, and clearing for
agricultural use). Commercial logging saw enormous growth
from the early 1960s to the mid-1970s. For a short period
in the early 1970s, the Philippines was supplying a substan-
tial share of total world timber exports. During the same
time, population in the uplands has grown rapidly and is now
on the order of 20 percent of total population. (C. Cruz,
this conference).

In the past, government policies on forest management have focused on "typical" goals - increased generation of income, foreign exchange, and employment. In recent years, two additional goals have been emphasised- reduction in the growth of environmental degradation and its resulting costs in downhill pollution, and improved welfare for people living in the uplands.

Extended discussions of the policy instruments designed to achieve these goals and some evaluation of their effectiveness have been written (de los Angeles, Power and Tumaneng). The instruments include a log export ban, a logging ban in certain regions, harvest fees and taxes, export taxes, long term leases for forestry concessions, investment incentives for wood processing, the Integrated Social Forestry Program and a new constitutional amendment to allow disposal of previously inalienable public land.

From a theoretical point of view, the impact of most of these policies is to change the returns to various forest related economic activities by changing some or all of the current and future prices of outputs, intermediate inputs, and factors of production. Price changes can be caused directly (for example, making capital available at an interest rate below the market rate), through taxes and subsidies (for example, harvest and export taxes), or through institu-

tional changes (for example, increasing the length of a lease and therefore lowering the discount rate of the lessee).

In addition to policies explicitly designed to affect forest resource utilization, there are a wide variety of national policies that also alter relative prices of forest inputs and outputs. These include the "standard" macroeconomic policies of monetary and fiscal policy, other macroeconomic policies such as exchange rate determination, minimum wages, and investment incentives, and infrastructure policies such as road and harbor building, and financing of agricultural research.

This paper presents two conceptual frameworks for analysing the impact of government policies on forest resource utilization. The first focuses on determinants of resource depletion, the rate at which the resource is extracted by economic activity. The second focuses on the impact of government policies on land utilization.

WHAT DETERMINES THE RATE OF DEPLETION?[2]

Start with a net present value maximizing unit (it may

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[2]This section is drawn from Nelson, 1982.

be a logging firm or a kainginero). It maximizes the net

present value of profits, π, (or utility) equal to a given

price, P, (or marginal utility of consumption) times the

rate of resource stock depletion, R, minus the cost of

extracting the resource (or marginal disutility of work)

subject to a production function which gives the rate of

depletion as a function of capital, K, and labor, L, ser-

vices used in production (with declining marginal productiv-

ities) and the current level of the stock. One possible

version of the problem follows.

$$\text{maximize } NPV\pi_0 = \int_0^\infty (pR - wL - iK)e^{-r}dt$$

$$R = F(K,L,S)$$

subject to

$$S(t) = S(0) + \int_0^t (-R(n) + H(Z))dn$$

w,i - wage and interest rate
r   - individual rate of time preference
H   - natural rate of resorce renewal
Z   - vector of variables affecting renewal rate; might
      include stock level.

(All variables are time dependent)

In general the following results seem intuitively plau-

sible.[3] The higher the price of the output, the faster the
rate of depletion. The higher the costs of production, the
lower the rate of depletion. Thus, if the cost of either
capital or labor is raised, the rate of depletion is
lowered. An increase in the discount rate, however, has the
effect of increasing the current rate of depletion because
future earnings are valued less. In a world of risk averse
behavior and capital market distortions, there is no reason
to suspect that the rate of interest charged on capital and
the rate of discount of the individual exploiting the
resource should be the same. In cases of exploitation of
open access resources, the individual rate of discount will
be much higher than the rate of interest (Clark, p7).

In addition to direction of change, it is of use to
have some idea of the magnitude of the change in resource
depletion. The elasticity of the rate of depletion with
respect to a particular price depends upon the relative
importance of the associated quantity variable in the pro-
duction function. For example, the elasticity with respect
to a change in the interest rate will be higher, the more

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[3] I have not derived these results explicitly and they
may depend on the form of the production function and the
natural renewal rate.

capital intensive production is. If production costs are relatively small (and resource rent is correspondingly large), the elasticity with respect to changes in costs of production will be relatively small while changes in output price will have more impact. A decrease in the discount rate (perhaps by providing long term leases) will decrease depletion more if the natural rate of renewal is low than if it is high.

THE IMPACT OF FOREST MANAGEMENT POLICIES ON RESOURCE DEPLETION

Using the relationships identified above, it is possible to examine the impact of forest management policies on resource depletion via their impact on relative prices. Table one indicates the expected impact of selected policies on prices and the expected net effect on resource depletion. Almost all of the policy instruments mentioned above act to reduce the rate of depletion. Most do so by reducing the output prices received by producers. Of the policies that reduce depletion, only long term leases affect other prices; in this case it is the rate of time preference or the individual discount rate.

EXPECTED IMPACT OF FOREST MANAGEMENT POLICIES ON PRICES
AND RESOURCE DEPLETION

	Output		Domestic price of Inter. Inputs		Capital	Labor	Discount rate	R
	T^1	NT^2	T^1	NT^2				
Log export ban	-	-	0	0	0	0	?	-
Logging ban	-	-	0	0	0	0	?	-
Harvest fees and taxes	-	-	0	0	0	0	?	-
Export taxes	-	-	0	0	0	0	?	-
Long term leases	0	0	0	0	0	0	-	-
Invest. incent. for wood processing	0	0	-	0	-	0	?	+
Social Forestry	0	0	0	0	-,0	0	-	?

Notes:

1. Tradable
2. Nontradable

Two forest management policies have either positive or ambiguous effects on resource depletion - investment incentives to wood processing and social forestry programs. Investment incentive reduce the cost of capital and often reduce the price of imported intermediate inputs via exemption from import duties. Social forestry programs

lower the individual's discount rate, but sometimes lower the cost of capital with government subsidies. In addition, they often increase the returns to family labor, inducing migration from areas with lower opportunity costs of family labor. Thus the net impact of social forestry programs on resource depletion is ambiguous.

THE IMPACT OF MACRO POLICIES ON FOREST RESOURCE DEPLETION

In the context of the above model, the most useful way to analyse the impact of macroeconomic policies is to think of them as altering relative prices -- between the cost of production and the price of output (changes in the price level), between the price of an individual factor of production and the price of output (changes in the price level, interest rate regulations and minimum wage laws), between prices of tradables and nontradables (exchange rate changes), and between prices of imports and exports (foreign trade taxes and controls). It is useful to examine a variety of macro policies to see their effects on these relative prices and what can be said a-priori about the impact on renewable resource depletion. Table 2 provides a summary of the expected effects described below.

TABLE TWO

EXPECTED SHORT RUN IMPACT OF MACRO POLICIES ON PRICES
AND RESOURCE DEPLETION

	Output T^1	NT^2	Inter. Inputs T^1	NT^2	Domestic price of Capital[3]	Labor[4]	Discount rate
Increased govt. exp.	0	+	0	+	+	–	?
Increased dom. taxes	0	–	0	–	–	+	?
Increase in money supply	0	+	0	+	–	–	?
Devaluation	+	0	+	+	?[5]	0	?
Trade taxes	+,–[6]	0	+,–[6]	0	0	0	?
Industrial incentives	0	+	0	+	–	0	?

Notes:

1. Tradable

2. Nontradable

3. Changes in the nominal interest rate. This assumes
inflationary changes do not affect the nominal interest
rate.

4. Changes in the real wage rate in the formal sector.
Note that increases in the formal sector wage rate will
lower the informal sector real wage rate by increasing
formal sector unemployment.

5. The impact of a devaluation on the nominal interest
rate depends upon the degree of capital mobility and
expectations about future devaluations.

6. Export (import) taxes lower (raise) the price of
exportables (importables), export subsidies raise the
price of exportables.

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"Standard" Macroeconomic Policies - Changes in the Money

Supply, Taxes, and Government Expenditure

While the state of the economy will influence the
impact of these policy changes, it seems reasonable to
assume that real wage reducing or inflationary changes, that
is, increases in the money supply and in government expendi-
ture, and decreases in general taxes, cause the price level
of goods to increase more than the nominal wage rate at
least in the formal sector.[4] Policies generally considered
to reduce nominal interest rates, that is, increases in the
money supply and taxes, and decreases in government spending
will generally cause the nominal interest rate to fall in
the short run (depending upon the degree of interest rate
control), but may cause an increase in the long run if the
rate of inflation increases.

If the only affect of inflationary changes in these
policies were to make real wages fall, the impact of these
policies would be to increase depletion. The shift down the
aggregate labor demand curve results not only in existing
firms hiring more workers, but also in previously marginal,

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[4]If the country is small and open, the impact of infla-
tionary policies is to increase the potential balance of
payments deficit and lead to incipient overvaluation.

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resource depleting activities becoming profitable. There are, however, two additional effects. If output and employment expand, the real wage rate in the informal sector will fall as more labor is drawn into the formal sector. If forest products are tradable, their prices won't change and increased domestic demand simply reduces exports. If, on the other hand, forest products are nontradable, increased domestic demand will push their prices up.

If inflationary policy changes also increase the nominal interest rate, the outcome is even less clear. The importance of an increase in the interest rate depends upon the capital intensity of production (and the extent to which the rate of discount changes). For a capital intensive logging operation a small increase in the interest rate can offset a large fall in the real wage, raise overall costs of the operation, and reduce depletion. (If the rate of discount also increases, the net result is unclear.) On the other hand, the same change may increase the amount of carabao logging by making it more lucrative for additional workers to be hired.

Exchange Rate and Foreign Trade Policies

An overvalued exchange rate raises the price of nontradables relative to tradables, increasing domestic consumption of tradables, reducing exports, increasing imports,

and increasing production of nontradables. If outputs from forest resource depletion are tradable or are substitutes for tradable commodities (for example, logs and firewood) the impact of an overvalued exchange rate is to reduce depletion by reducing the price of the output relative to nontradable goods (including factors of production) in the economy. If forest resource outputs are exported and production inputs are not imported, there will be no direct impact on depletion from import taxes. As mentioned above, export taxes have been explicitly imposed to reduce pressure on resources by lowering the price of the (exported) output. Even if no export taxes are imposed, however, trade tax regimes turn the terms of trade against all exportables, lowering their relative prices. This may well cause a reduction in depletion.

If labor is abundant, trade taxes encourage excessively capital intensive production techniques and tend to reduce wage rates, increasing unemployment and depletion rates. As a result, depletion rates may increase.

Investment Incentives and Interest Rate Policies

As a general rule, policies of this type lower both the interest rate and the cost of imported capital equipment. The individual rate of discount may or may not be affected. Investment incentives often include duty free imports of

capital goods, accelerated depreciation, exemption from income taxes, and subsidized interest rates. Furthermore, commercial logging operations are often large and have good relationships with banks. Thus they are more likely to be able to take advantage of special programs with low interest rates. Because capital costs are reduced, these policies encourage more capital intensive production techniques, and because the cost of production is lowered, increased depletion results.

As can be seen in Table 2, the net impacts of most macro policy changes on resource depletion are not unidirectional. They depend on the input and output price elasticities. One of the most important areas of future research is to begin to quantify the impact of relative price changes on the rate of resource depletion. Table 3 presents my speculations on short run impacts of macro policies on resource depletion by kaingineros and commercial loggers. For example, the expected impact of increased government expenditures on depletion by kaingineros is negative. Increased government expenditures increase aggregate demand which increases employment in the formal sector and increases the wage rate in the informal sector. Increased government expenditures also increase the overall price level, thus increasing prices for nontraded inputs, but

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forest output prices do not increase because they are deter-

mined by world prices. Hence for the kainginero, the cost

of labor and inputs goes up while price of output stays

constant, reducing profitability and resource exploitation.

TABLE THREE

EXPECTED SHORT RUN IMPACT OF MACRO POLICIES ON
THE RATE OF FOREST RESOURCE DEPLETION

	Depletion by Kaingineros[1]	Depletion by Commercial Loggers[2]
Govt. Exp.	-	-,0
Domestic taxes	+	+,0
Money Supply	-	+,0
Devaluation	+	+

Notes:

1. It is assumed that kaingineros use labor intensive production techniques, pay informal sector wages, use few intermediate inputs, and produce traded output.

2. It is assumed that commercial loggers use capital intensive production techniques, use many tradable intermediates and produce traded output.

Even with the distinction between kaingineros and

commercial loggers, the impacts of government policies are

not always clear. The final effect will depend upon the

technological relationship between inputs and outputs for

each type of processing.

THE IMPACT OF POLICIES ON FOREST LAND UTILIZATION[5]

The diagram below, common to many land economics textbooks (for example, Barlowe), provides a useful tool for analysing the impact of government policies on forest land utilization. The vertical axis represents the labor absorptive capacity of a unit of land, the horizontal axis represents declining quality of land. For example, the leftmost land might be irrigated rice land, the rightmost is low productivity, steeply sloped uplands. The FF line represents the quantity of labor which can profitably be employed on the land. It represents the point where the value of the output an additional worker contributes is just equal to the cost of employing him.[6] The position and slope of the line is determined by the production technology adopted on each land type, and prices of outputs, intermediate inputs, and factors of production. The rightmost region or the horizontal direction is referred to as the "extensive margin", the left upper region or the vertical direction as the "intensive margin".

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[5]Wilfrido Cruz provided the inspiration for this section and many of the ideas it contains. He is not responsible for any of the mistakes that might remain in it.

[6]Only one variable input is usually considered.

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FIGURE ONE
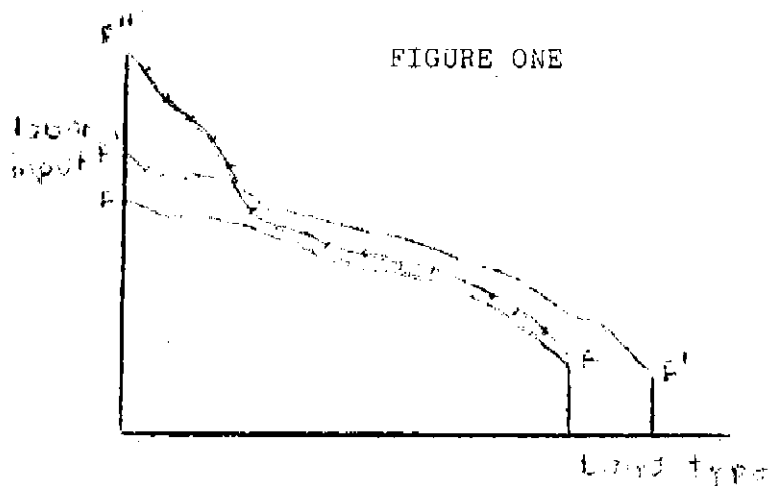
In this context, the impacts of forest (and other commodity) specific policies and general macro policies differ. Macro policies affect prices of inputs and outputs for all commodities more or less uniformly. Thus a macro policy change that lowers real wage rates will shift FF upwards along its whole length. It will shift outward both the intensive and extensive margin to FF'. If all agricultural outputs are traded, then a devaluation will also shift FF upward. In both cases, the slope may change.

Commodity-specific policies, on the other hand, act on certain segments of the line. For example, a log export ban reduces the domestic price of logs and shifts the extensive margin inward. Technological change is often commodity-specific and thus alters only segments of FF. For example, research that increases the productivity of irrigated lands will shift the intensive margin upwards, but will either

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have no effect on the extensive margin or will shift it
inward if the opportunity cost of labor is increased ($F''F$).
On the other hand, research that increases the productivity
of marginal lands might increase the intensive margin, but
will definitely increase the extensive margin.

Institutional innovation can potentially increase both
the intensive and extensive margins. For example, granting
previously inalienable lands to the individual currently
occupying that land would increase the perceived security of
tenure, and lower his discount rate, thereby reducing his
rate of resource depletion. It would encourage him to adopt
agricultural activities with longer run payoffs. The likely
impact on the new owner's land use is to reduce labor use in
the short run. If such a policy change encourages more
individuals to occupy land illegally in order to obtain
legal ownership, it is likely to push out the extensive
margin, bringing more marginal lands into use.

RESEARCH ISSUES

In order to apply the conceptual approaches described
above, much more information is needed than is currently
available on the quantitative relationships between inputs
and outputs in forest resource depletion. In order to
estimate the depletion rate response to price changes, it is
necessary to have better production function information.

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It is only with this kind of information that informed decisions on the appropriateness of government policies and recommendations for future change can be made.

At the same time, there is less than adequate understanding of the linkages between macro policy changes and prices of inputs used and outputs from forest resources. Analyses of linkages among macro policies, unemployment in the formal and informal sectors, and migration are especially important. Data collection needs include prices of labor, intermediate inputs, and outputs at the "farm" level.

National government policies affect forest resource depletion via both direct price effects and indirect effects. An example of the latter is support of research funding (increased labor productivity in rice cultivation) that pushes the intensive margin outward and reduces pressure on the extensive margin. When government funds are scarce, it becomes important to evaluate the tradeoff between financing programs that reduce resource depletion directly and those that increase labor productivity elsewhere and thus reduce depletion indirectly.

BIBLIOGRAPHY

Barlowe, Raleigh (1972), Land Resource Economics, Prentice-Hall, Inc.

Clark, Colin W. (1976), Mathematical Bioeconomics, The Optimal Management of Renewable Resource, John Wiley and Sons, Inc.

De los Angeles, Marion (1982), "Forest Policies for Development Planning", in PIDS Surveys of Philippine Developmental Research II.

Nelson, Gerald C. (1983), "Approaches to Reducing Renewable Resource Depletion and Environmental Degradation: Social Forestry or Macroeconomic Policies", paper prepared for the Agricultural Economics Society of Southeast Asia Conference, Bangkok, November 16-20, 1983.

Power, John and Tessie Tumaneng (1983), "Comparative Advantage and Government Policies in Forestry", paper prepared for the workshop on the Impact of Economic Policies on Agricultural Development project, Tagaytay, March 25-26,1983.

Revilla, A. V. Jr. (1984), "Forest Development by Public Corporations", paper presented at the workshop on Policy-Oriented Research on Equity in Natural Resource Development: Issues and Data Needs, Tagaytay, January 30-31, 1984.